MINOS+ Status Report

Donatella Torretta

All Experimenters' Meetings

March 17, 2014

Far Detector

DAQ

- New DAQ kept running all week despite ROP timing warning messages (details follow)

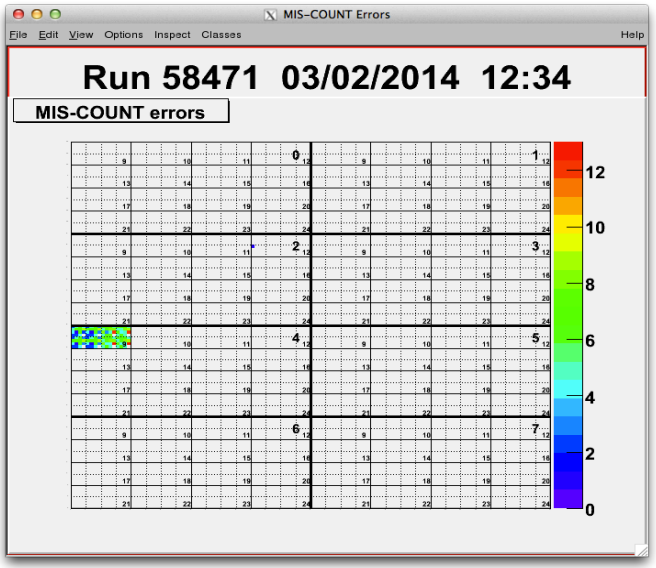
Electronics

- Crate 4 PPS auxiliary system monitor problem
  - Crate 4 time plot is wrong
  - Replaced several components in the Crate (TRC, cables, MVME CPU, etc.) it still does not work properly
  - Main system in Crate 2 is working fine
  - Do not expect this problem to affect data quality

Near Detector

Electronics

- Master 4-9 showed MIS-COUNT errors in each and every Minders menu
  - it was replaced during the DAQ crisis. The errors are now gone.



- Hot channel 6-20-5
  - Need to replace the Minder at the next beam downtime

Near/Far Detectors Timing Problems

Symptoms

- Starting on Sunday March 9, after a **Soudan network outage**, the rate of timing warnings increased at both Minos Near and Far detectors
  - 1st ND error appears at 14:21
  - 1st FD error appears at 16:55
  - FD DAQ kept running despite the timing warning messages
  - ND DAQ crashed and was unable to run
- **Daylight Saving Time** same day

Near/Far Detector Timing Problems

ND/FD Timing Systems

- The timing at both detectors is provided by an interface to a GPS system to get the absolute time to high precision and high dynamic range

- A 10 MHz clock generated by the GPS provides the fine grain timing clock to the Master (Near) and VARC (Far) readout cards, and provides the time within a one second time frame

- A 1 Hz PPS "Pulse Per Second" synchronous clock generated by the same GPS provides the coarse and absolute one second time bin, fanned out to the Timing Controller cards in each VME crate (VTM Near, TRC Far)

- A timing computer "TPC" receives the GPS absolute time marker from the GPS unit and serves the VME Read Out Processors (ROPs) the time via SNTP protocol.

- Important: NO external source of timing is used in this system

Near Detector Timing Problems

ND/FD Timing Systems

- The timing cards converts the PPS into 20 50 millisecond time blocks, with a VME interrupt generated each block. At the end of a one second time frame, the ROP attaches its system time to the data stream, thus specifying the absolute second, and sends data to trigger processor farm (TP)
- The Trigger Processor (TP) checks the synchronization across the eight (Near) or sixteen (Far) VME readout crates: warning threshold of 50 milliseconds skew on the relative timing between crates, and a threshold of 80 milliseconds discrepancy to the absolute time expected. Time Frames are defined to start at exactly one second intervals, on the one second boundary.
- The TPs reported frequent (every few seconds) warnings that the timing checks exceeded the warning threshold.
- NB: The fatal error threshold is when the TPs cannot determine the absolute second of the time frame. This **NEVER** happened during this week, and we expect the data to be good, whatever had been taken (mostly at Far)
- At the Near detector we had another error in the front-end code timing check, in which the crates seemed to miss a 50 msec time block at the beginning of a time frame. This problem made the run stop, and Near detector took very little data during this time.

Near Detector Timing Problems

ND trouble shooting actions

We suspected and tested several possibilities (Monday/Tuesday):

1. an unexpected NTP server causing problems;
2. Network traffic or hardware problems causing increased network latency;
3. ROP and server CPU busyness interfering with operations;
4. an NTP hacking attack as occurred recently;
5. network router configuration problems after the Soudan network outage;
6. communications problems between the near and far detectors;
7. many other smaller issues

Near Detector Timing Problems

ND trouble shooting actions

- On Wednesday afternoon, March 12, we were able to operate the Near detector without any warning or errors while the Minos underground network was **completely isolated** from the Network (which made us strongly suspect an external network agent was causing problems).

- On Thursday March 13, we ran even longer at ND without any problems.
- We gradually re-instituted various network connections for things like data file archiving and near/far spill service network connection, ssh and kerberos services.
- During this process, the FD issued its last timing check warning (14:45 pm) shortly before the SpillServer connection was enabled (15:00 pm)

- Gradually we opened everything up as it had been prior to the problems and still NO more warnings or errors happened since.

Near Detector Timing Problems

Final Comments – Current Status

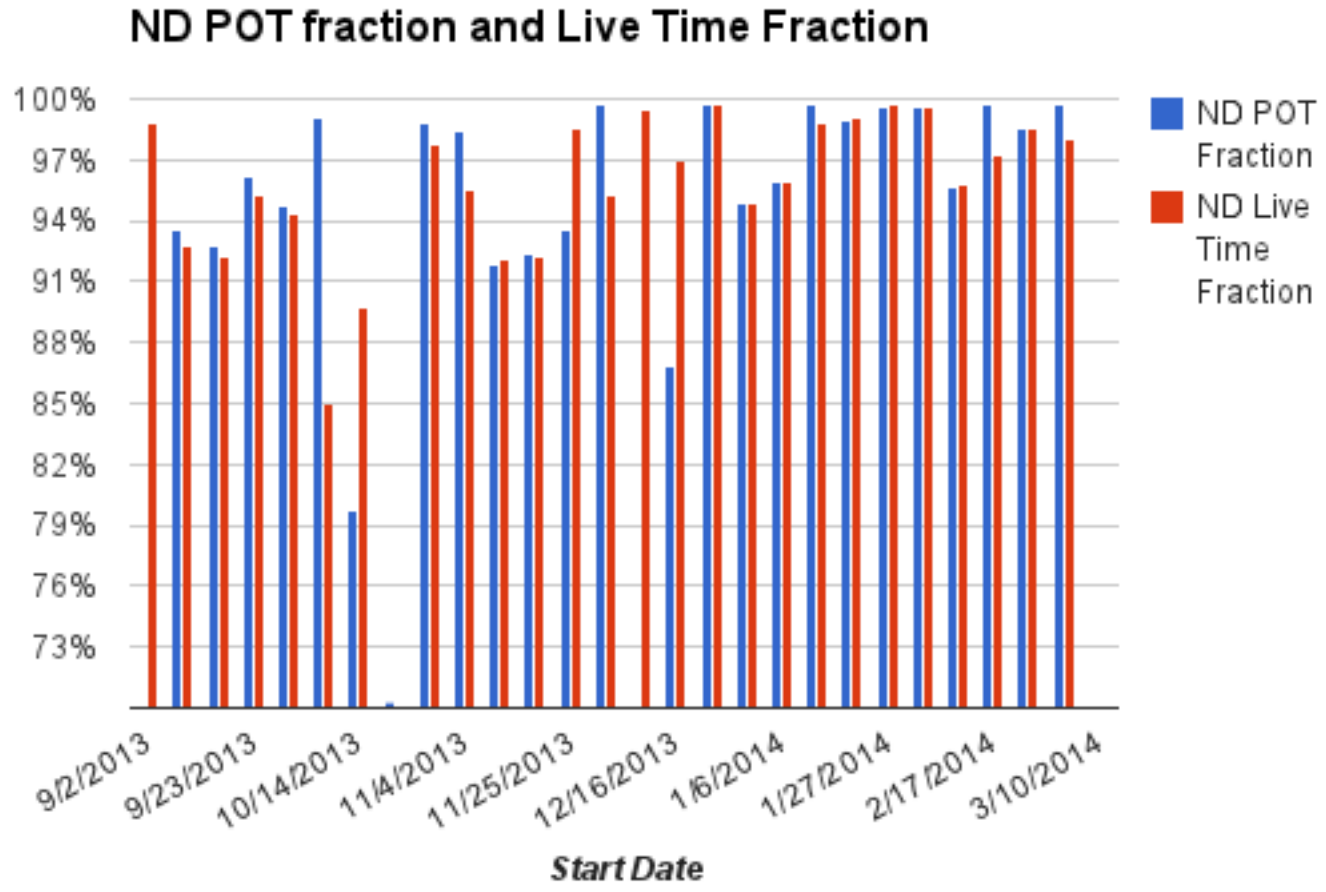
- We **do not** understand the root cause of the problem, but suspect a transient network issue, malicious or not.
- Former Timing Expert says: "We saw problems like this in the early days of Minos: source then was a misconfigured router delaying packets ".

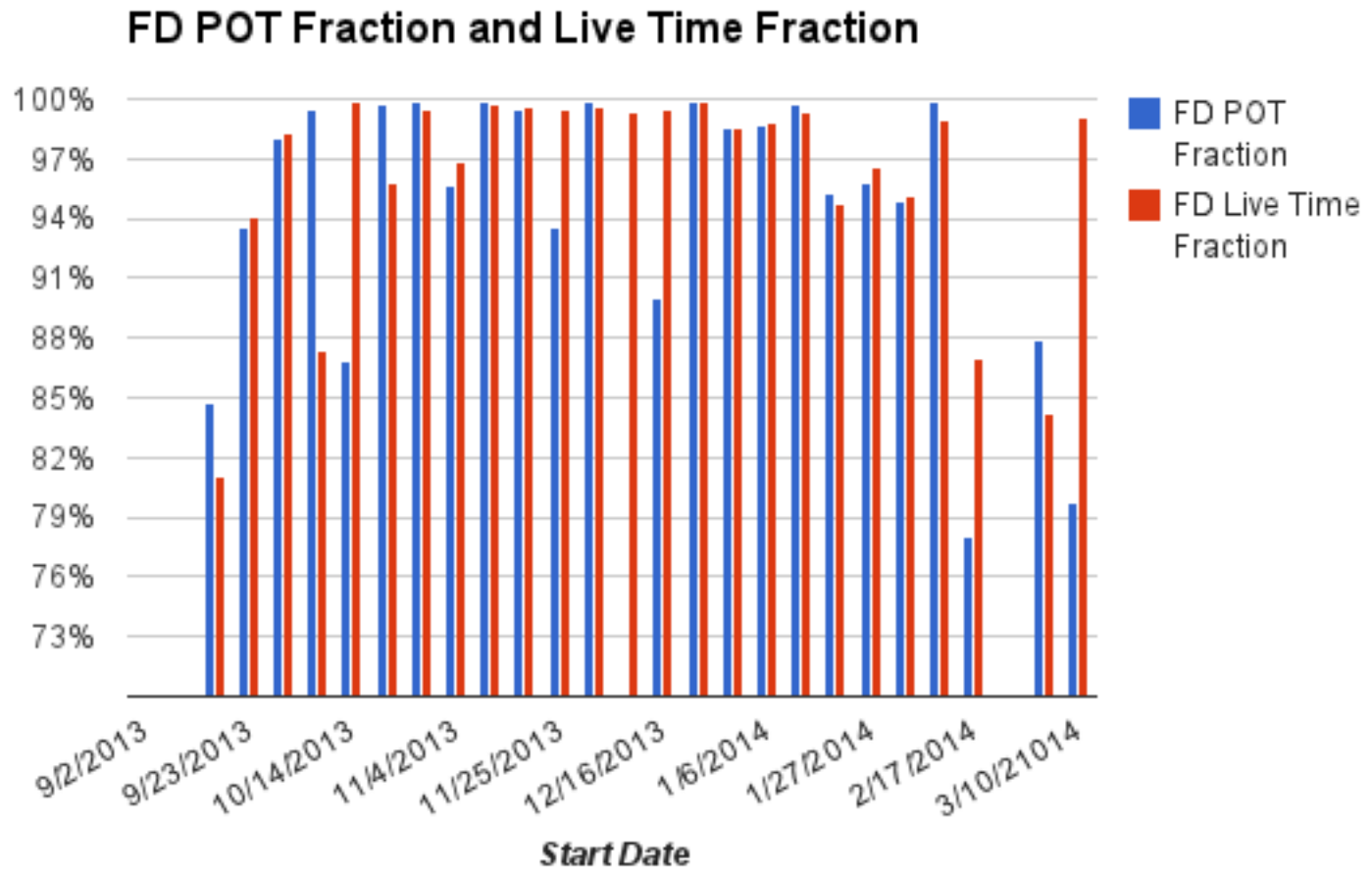
- We have not seen problems since Thursday and are watching carefully.
- If there is a two day beam shutdown this week, we may try more tests.
- Should the problem come back, we could temporarily disconnect ND from the network and keep taking data. Ugly, but possible.
- Computer Security People need to be involved

- Data Quality group processed the data taken last week:
  - Unfortunately the data taken Sunday-Thursday is not usable
  - From Thursday on, data are OK again

MINOS+ Status

		Near Detector		Far Detector	
Start Date/Time	**End Date/Time**	**POT Fraction**	**Live Time Fraction**	**POT Fraction**	**Live Time Fraction**
12/30/13 00:00:00	01/06/14 00:00:00	94.9%	94.9%	98.5%	98.5%
01/06/14 00:00:00	01/13/14 00:00:00	95.9%	95.9%	98.7%	98.8%
01/13/14 00:00:00	01/20/14 00:00:00	99.7%	98.8%	99.8%	99.3%
01/20/14 00:00:00	01/27/14 00:00:00	99.0%	99.1%	95.2%	94.8%
1/27/14 00:00:00	2/3/14 12:00	99.7%	99.7%	95.8%	96.6%
2/3/14 00:00:00	2/10/14 12:00	99.5%	99.6%	94.9%	95.2%
2/10/14 00:00:00	2/17/14 12:00	95.7%	95.7%	99.9%	99.0%
2/17/14 00:00:00	2/24/14 12:00	99.7%	97.2%	78.0%	87.0%
2/24/14 00:00:00	3/03/14 12:00	98.5%	98.5%	2.09%	2.13%
3/03/14 00:00:00	3/17/14 12:00	33.6%	48.5%	79.8%	99.1%


ND POT fraction and Live Time Fraction
100%
97%
94%
91%
88%
85%
82%
79%
76%
73%
9/2/2013
9/23/2013
10/14/2013
11/4/2013
11/25/2013
12/16/2013
1/6/2014
1/27/2014
2/17/2014
3/10/2014
Start Date
ND POT Fraction
ND Live Time Fraction


FD POT Fraction and Live Time Fraction
100%
97%
94%
91%
88%
85%
82%
79%
76%
73%
9/2/2013
9/23/2013
10/14/2013
11/4/2013
11/25/2013
12/16/2013
1/6/2014
1/27/2014
2/17/2014
3/10/21014
Start Date
FD POT Fraction
FD Live Time Fraction

…… even Google has problems sometimes ……

Google

502. That's an error.

The server encountered a temporary error and could not complete your request.

Please try again in 30 seconds. That's all we know.